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FLOOD INSURANCE STUDY
TOWNSHIP OF TIONESTA, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Tionesta, Forest County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

This Flood Insurance Study was prepared by compiling pertinent information for the flood hazard areas in the Township of Tionesta from existing technical and/or scientific data originally prepared by others for purposes other than the preparation of this Flood Insurance Study. This existing data was reviewed by the Federal Emergency Management Agency (FEMA) prior to its use in the development of this Flood Insurance Study to ensure compliance with National Flood Insurance Program (NFIP) accuracy requirements.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This study is a revision of the original study published for Tionesta. The hydrologic and hydraulic analyses for this revision were performed by the Pittsburgh District of the U. S. Army Corps of Engineers (COE) during the preparation of the Flood Plain Information report for the Allegheny River in Forest County. The COE report was completed in December 1974.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Tionesta, Forest County, Pennsylvania. The Borough of Tionesta is not included in this study. The area of study is shown on the Vicinity Map (Figure 1).

The Allegheny River was studied by detailed methods for its entire length within the community. This revision involved the addition of detailed flooding for the Allegheny River. Base flood elevations are now shown on the maps. The areas studied by detailed methods were selected based upon the extent and validity of available existing hydrologic and hydraulic data.

Tubbs Run, Tionesta Creek, Little Tionesta Creek, North Branch, Hemlock Creek, McCauley Run, and East Branch were studied by approximate methods. Approximate methods of analysis were used to study all remaining areas having a potential flood hazard that did not have available scientific or technical data.

2.2 Community Description

The Township of Tionesta is located in the southwestern corner of Forest County in northwestern Pennsylvania, approximately 80 miles north of the City of Pittsburgh. It is bordered by the Townships of Harmony and Hickory to the north, the Township of Green to the east, the Township of Washington to the south, and the Townships of President and Pinegrove to the west.

The Allegheny River, with a total drainage area of 11,748 square miles at its confluence, joins with the Monongahela River at Pittsburgh to form the Ohio River. The headwaters of the Allegheny River are in the western slope of the Appalachian Mountains in Potter County in northwestern Pennsylvania. It flows northwest from its source to Portville, New York, near the New York-Pennsylvania border. It then flows west to Salamanca, New York, and south into Pennsylvania to its confluence at Pittsburgh, a total distance of 322 miles. The river flows south through Tionesta. Tionesta Creek is the only major tributary of the Allegheny River within Forest County.

The average bed slope of the Allegheny River within Forest County is 3.3 feet per mile. The valley floor widths range from 0.1 to 0.5 mile. The land elevation ranges from a low of 850 feet to a high of 1,900 feet, with an average of approximately 1,500 feet.

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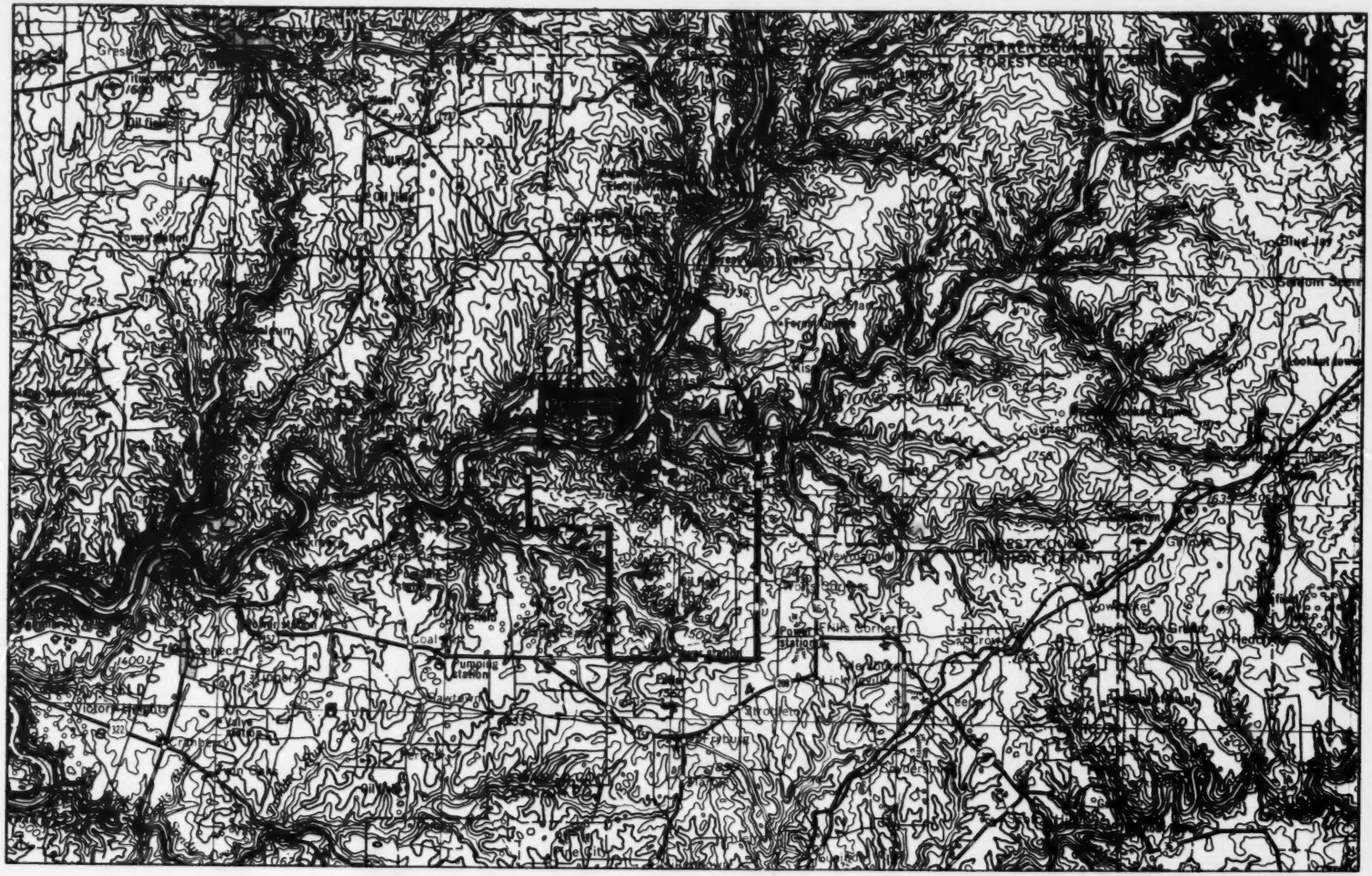

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF TIONESTA, PA
(FOREST CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

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The climate of the area is temperate with a normal seasonal variation in temperature. Forest County is geographically located in a region of both polar and tropical air mass activity, subject to continental and maritime invasion. The weather is usually moderate but may have occasional rapid changes resulting from frontal air mass movements. Temperatures seldom exceed 90 degrees Fahrenheit (°F) in mid-summer or dip below zero in the winter months. Measurable precipitation occurs on an average of 149 days a year and amounts to an annual average of 42 inches. Of this amount, approximately 58 percent is lost through evaporation, transpiration, and infiltration. The remainder moves into the streams as runoff.

2.3 Principal Flood Problems

Major floods have occurred on the Allegheny River at various times of the year. However, the main flood season is usually from December through April. Most of the floods during this period are the result of heavy rain and snowmelt. It is possible for large floods with a duration of several days to occur at any time of the year. Although summer floods are rare on the Allegheny River, the flood of June 1972 was of considerable magnitude but was contained mostly within the banks in Forest County through the impoundment of floodwaters by upstream flood control dams.

It should be noted that although there are no obstructions to floodwaters, the topography of the river valley is such that ice gorges can occur. These huge jams of broken ice form temporary, but effective, dams across the stream, resulting in high localized flood stages.

Ice jams have historically been a problem on the Allegheny River, and although the Kinzua and Tionesta Dams have reduced flows through Forest County, the chance of ice jams still exists. The ice jams can cause unpredicatable rises in river stage along with abnormal amounts of damage.

The maximum flood of record for this portion of the Allegheny River occurred in March 1956. Ice jams caused even higher crest elevations in localized areas in February 1945 and January 1964.

Flood elevations for Forest County were determined using U. S. Geological Survey (USGS) records from stream gaging stations along the Allegheny River at Franklin and West Hickory. The gage at West Hickory was established in October 1941 and is located at the State Route 127 bridge 0.8 mile downstream from East Hickory Creek.

To supplement the gage records, newspaper files, historic documents, and records were searched. Additional high-water data, obtained by field observations and interviews with local residents, were referenced to benchmark elevations.

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Figure 2 shows potential 100- and 500-year flood heights along the Allegheny River in the Township of Tionesta.

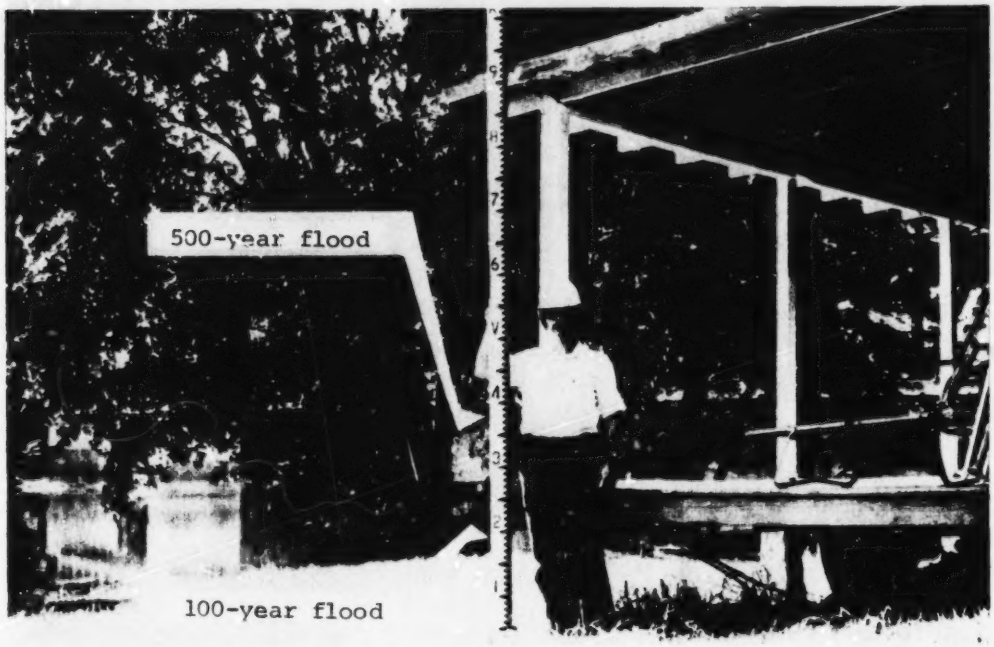

Figure 2 - Potential 100- and 500-year flood heights on the Allegheny River at Hunter Cottage upstream of the first State Route 62 bridge crossing.

2.4 Flood Protection Measures

There are two upstream flood control dams and reservoirs built, operated, and maintained by the COE that act to reduce flood levels on the Allegheny River within Tionesta. Tionesta Dam and Reservoir, located on Tionesta Creek 5 miles above Forest County, control 478 of the 480 square miles of the creek's total drainage area, thus nearly negating any contribution to downstream flood stages on the Allegheny River from this tributary. The dam has been in operation since December 1940. Kinzua Dam and Allegheny Reservoir, located on the Allegheny River 50 miles above Forest County, control 2,180 square miles of drainage area. The dam was completed in January 1967. With the completion of Tionesta and Kinzua Dams, the risk of flooding in Tionesta has been greatly reduced.

Tionesta and Kinzua Dams are both formidable structures, creating lakes of 2,770 and 21,180 acres, respectively, with the general areas surrounding each being allocated for conservation and recreation usage. Tionesta Dam consists of an impervious core with rolled earthfill to an elevation of 154 feet above the stream bed. The outlet control works

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consist of a tower and an 1,875-foot long, 19-foot diameter tunnel, with the discharge regulated by three vertical-lift gates. Kinzua Dam is a concrete structure flanked by an earth embankment on the right bank. It rises to a height of 179 feet above the stream bed and has six low level and two high level sluice outlets, all of which are controlled by hydraulically operated 5-2/3 by 10 feet slide gates.

The impoundment capabilities of this system of reservoirs reduce major flood crests at the Franklin gage by 4 to 5 feet, while Kinzua Dam reduces crests at the West Hickory gage by 5 to 6 feet. During the flood of June 1972, the flood crest at West Hickory was reduced 8.5 feet by Kinzua Dam.

River forecasting service is provided by the National Weather Service of the National Oceanic and Atmospheric Administration. Approximately 50 daily reports of river levels and precipitation amounts from a network of observers established by the National Weather Service and the COE are used in preparing general river forecasts. In 1955, the Commonwealth of Pennsylvania established an efficient Civil Defense Organization on a statewide basis for the dissemination of flood warnings.

The Office of Civil Defense directs and coordinates all flood disaster operations from the Civil Defense Emergency Operating Center. The Red Cross, state troopers, the Salvation Army, and the National Guard are alerted and utilized as necessary. Close contact is maintained by the Director of Civil Defense with the COE and weather forecasting personnel before, during, and following all flood emergencies.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to

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approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for the flooding source studied in detail affecting the community.

Discharges for the Allegheny River were obtained from the COE Flood Plain Information report for the river in Forest County (Reference 1). In that report, a statistical analysis of streamflow records was used to develop frequency curves at specific locations. From these curves, the 100- and 500-year flood flows were selected and adjusted to reflect reductions by the upstream flood control dams and reservoirs.

A summary of drainage area-peak discharge relationships for the Allegheny River is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
ALLEGHENY RIVER					
At the downstream corporate limits	4,219	*	*	63,000	80,300

*Data not available

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Stream valley configuration was determined from field surveys conducted at pertinent locations along the Allegheny River. Data for structures were compiled from field observations and publications of the Pennsylvania Department of Transportation.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1).

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Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 2). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the Allegheny River were determined by the slope/area method.

Channel roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of field inspections of flood plain areas. For the Allegheny River, the channel "n" values ranged from 0.025 to 0.030, and the overbank "n" values ranged from 0.050 to 0.090.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD).

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year flood plain boundaries and 100-year floodway to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 24,000 with a contour interval of 20 feet (Reference 3).

For the streams studied by approximate methods, the boundary of the 100-year flood was delineated using USGS flood-prone area maps (Reference 4).

The 100- and 500-year flood plain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood

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hazards (Zones A and AE), and the 500-year flood plain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 3.

No floodway is shown for the Allegheny River since there was no floodway delineated in the report this study is based on.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown in this area.

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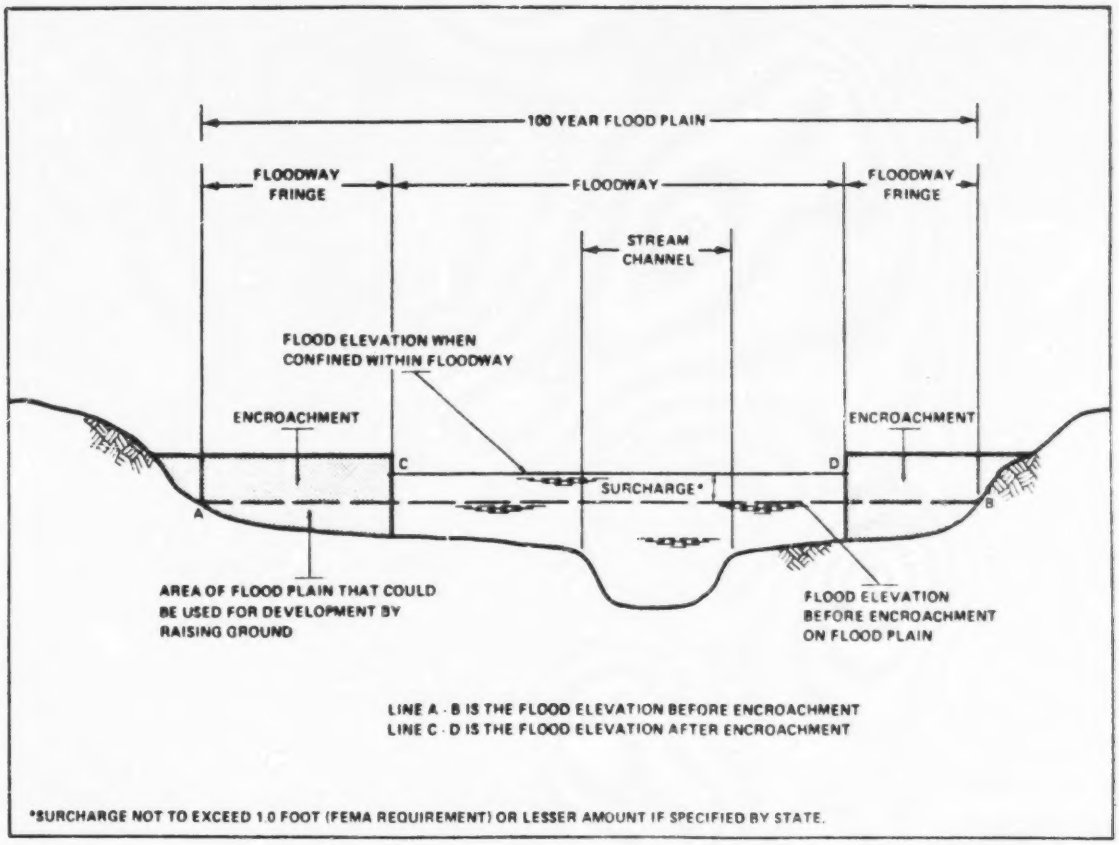
100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 3

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year flood plain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Zone V areas are determined by approximate methods, and base floods elevations are not shown.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year flood plain, areas within the 500-year flood plain, and to areas of 100-year shallow flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and flood plain management applications.

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For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year flood plains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For flood plain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year flood plains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared by other organizations originally for purposes other than the preparation of this Flood Insurance Study. The data was identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the NFIP. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, Federal Emergency Management Agency (Regional Director, Region III Office, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106) for consideration for revision of this study.

The COE has prepared a Flood Plain Information report for the Allegheny River in Forest County (Reference 1). The data in this study were obtained from that report.

Flood Insurance Studies for the Townships of Harmony and Hickory and the Borough of Tionesta are currently being prepared (References 5, 6, and 7). The results of those studies will be in exact agreement with the results of this study.

A Flood Insurance Study has been published for the Township of Tionesta (Reference 8). The differences between the previous study and this study are justified due to the more detailed nature of this Flood Insurance Study.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division,

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Federal Emergency Management Agency, Regional Director, Region III Office, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

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2. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, September 1971.

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4. U. S. Department of the Interior, Geological Survey, Maps of Flood-Prone Areas, Scale 1:24,000, Contour Interval 20 Feet: Tionesta, Pennsylvania, 1973; West Hickory, Pennsylvania, 1973.

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6. Federal Emergency Management Agency, Flood Insurance Study, Township of Hickory, Forest County, Pennsylvania (Unpublished).

7. Federal Emergency Management Agency, Flood Insurance Study, Borough of Tionesta, Forest County, Pennsylvania (Unpublished).

8. Federal Emergency Management Agency, Flood Insurance Study, Township of Tionesta, Forest County, Pennsylvania, Washington, D. C., February 15, 1985.

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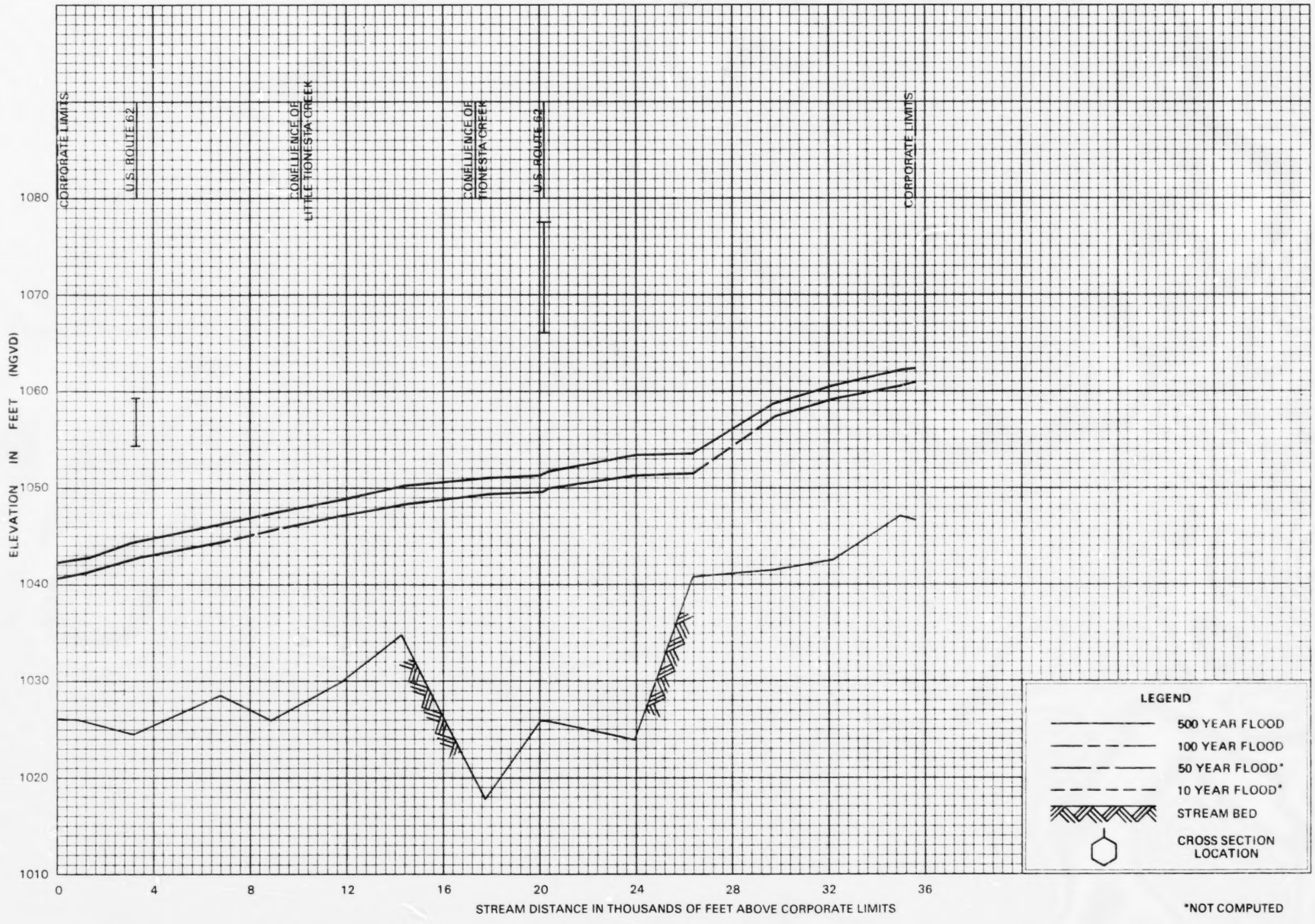

FLOOD PROFILES

ALLEGHENY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF TIONESTA, PA

(FOREST CO.)

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